Claims

1. A recording device for perpendicular recording comprising a magnetic head and a recording medium,

the recording medium comprising a substrate and a magnetic underlayer on the substrate,

the underlayer comprising an easy axis of magnetization directed in a direction substantially transverse to a traveling direction of the magnetic head.

2. The recording device of claim 1, wherein the underlayer comprises a substantially radial or transverse anisotropy.

3. The recording device of claim 1, wherein the underlayer comprises a soft magnetic material.

4. The recording device of claim 1, wherein the underlayer provides a return path for a recording head.

5. The recording device of claim 4, wherein the underlayer amplifies a perpendicular component of a write field in a recording layer overlying the underlayer.

6. The recording device of claim 1, wherein the underlayer has low magnetostriction.

7. The recording device of claim 1, wherein the underlayer comprises a material selected from the group consisting of a permalloy, a CoZrNb alloy, a NiFe alloy and a FeAlN alloy.

8. The recording device of claim 1, wherein the recording medium is selected from the group consisting of a disk and a tape.

9. The recording device of claim 1, wherein the underlayer has the easy axis of magnetization induced by a magnetron field.

10. The recording device of claim 1, wherein a thickness of the soft magnetic underlayer is about 200-400 nm.

11. A method for manufacturing a magnetic recording disk for perpendicular recording, comprising:

applying a magnetron field and

depositing an underlayer on a substrate,

wherein the underlayer comprises an easy axis of magnetization directed in a radial direction of the magnetic recording disk.

12. The method of claim 11, further comprising heating the substrate.

13. The method of claim 11, wherein the depositing an underlayer is by sputtering.

14. The method of claim 13, wherein the sputtering is a reactive sputtering.

15. The method of claim 11, wherein the substrate is kept stationary during said depositing a magnetic underlayer.

16. The method of claim 15, wherein a diameter of a magnetron source producing the magnetron field is larger than a diameter of the substrate.

17. The method of claim 11, wherein the substrate is rotated during said depositing a magnetic underlayer.

18. The method of claim 17, wherein a size of a magnetron source producing the magnetron field is smaller or comparable to a diameter of the substrate.

19. The method of claim 18, wherein the substrate is placed off-center with respect to the magnetron source.

20. A magnetic recording disk for perpendicular recording, comprising a substrate and means for providing a return path for a recording head.

21. A disk drive comprising a magnetic recording disk for perpendicular recording, wherein the magnetic recording disk comprises a substrate and a magnetic underlayer on the substrate, wherein the underlayer comprises an easy axis of magnetization directed in a radial direction of the magnetic recording disk.